A STUDY AND ANALYSIS OF THE MIGRATION POTENTIAL OF ATRAZINE INTO SELECTED AQUIFERS IN SELECTED COUNTIES OF CALIFORNIA IN 1981

by

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SUMMARY

Studies in Nebraska and Iowa have raised the question of possible ground water contamination by atrazine in California. A review and analysis of the available literature concerning the mobility and degradation of atrazine in various soil types was performed in conjunction with an analysis for atrazine residues in water from underground sources. The counties of Fresno, Merced, and San Joaquin were selected for sampling with San Joaquin County being the "worst possible case" situation. The area selected in San Joaquin County had a history of high use of atrazine and very permeable soils. Most samples were taken from domestic supply wells with only a few from non-potable well supplies. It would appear that atrazine does not have a high migration potential in clay soils, and has only limited mobility in sandy soils. The data suggested that atrazine would not seriously affect ground water supplies through contamination by internal soil percolation. With a minimum detectable limit of 2 ppb, all 15 samples were negative.

INTRODUCTION

Since their synthesis in 1952, the triazine herbicides have become important agricultural chemicals for the eradication of weeds. One particular herbicide, atrazine (2-chloro-4-ethylamino-6-isopropylammino-s-triazine) has been extensively used throughout the United States. Atrazine's advantages include good water solubility and post-emergence activity. These properties made atrazine a prime candidate for weed control in corn, since corn has a high tolerance for atrazine. Another advantage, from the safety standpoint, is its low toxicity. The acute oral LD_{50} in rats is 3080 mg/kg (3).

Recent studies in Nebraska and Iowa have raised the question of possible groundwater contamination by atrazine. The problem of crop injury from contaminated irrigation water notwithstanding, there are concerns about finding any pesticide, including atrazine, in domestic aquifers.

To ascertain if atrazine had in fact penetrated groundwater supplies in California, samples were taken from groundwater supply systems. A review and analysis of the available literature concerning atrazine migration and degradation was also performed.

METHODS AND MATERIALS

A total of 15 water samples were taken for atrazine analysis. Nine samples were taken from San Joaquin County, 3 from Merced County, and 3 from Fresno County. The samples taken from San Joaquin County were specifically for atrazine, while the remaining samples were taken as part of an ongoing effort to monitor pesticide contamination of domestic groundwater supplies. In San Joaquin, the samples came from areas of high atrazine use and permeable soils. Sample sites were also selected for high water tables whenever possible. The Fresno and Merced County samples came from areas of general pesticide use, where atrazine was among the herbicides used in the area. However, San Joaquin County, because of the nature of the soil/aquifer interface and the history of atrazine usage, was selected as the "worst case" situation.

In most cases, the samples were taken from domestic supply wells, though a few were taken from non-potable (high salt) well supplies. Quart-sized containers were filled to the brim, covered with aluminum foil, and sealed with their tops. The samples were chilled in wet ice and analyzed within 48 hours.

Atrazine was extracted from the water samples by partitioning 3 times with benzene. The extract was dried through a bed of anhydrous sodium sulfate, made to a final volume, and analyzed by gas-liquid chromatography. The chromatograph was a Hewlett-Packard HP5880 equipped with a nitrogen-phosphorus detector. A 6 ft. x 2 mm (i.d.) glass column packed with 10% SP2100 on 100/120 mesh Chromosorb WHP at 195°C. was used. By following the manufacturer's suggestions for detector operation, recoveries of atrazine using this method were nearly 100 percent.

RESULTS AND DISCUSSION

None of the samples showed any detectable level of residue. The minimum detectable level for atrazine in water, by our method, is 2 ppb.

It would appear that even in the worst case condition of San Joaquin County with its permeable soil, high water table, and high atrazine use, the possibility of atrazine contamination is unlikely. Indeed, J.K. Hall states that the "...application of atrazine to fine-textured soils...would not seriously affect groundwater supplies through contamination...." (4). Several studies have shown atrazine to be relatively immobile or to possess an intermediate order of mobility (4)(5)(6)(7)(17). Studies on the leaching potential of atrazine show that it is most likely to migrate through heavily irrigated, sandy, or otherwise permeable soils, when it migrates at all (1)(2)(8)(9)(10)(12)(13)(14)(15)(18). The migration potential through clay soils is very low (16)(4). There are cases of groundwater contamination in Iowa and Nebraska (9)(11)(15), but the conditions in those areas are not the same as conditions found in California.

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